PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Second Exam A **DISCRETE STRUCTURES** **05–05–2010**

Part 1 Each problem is worth 2 points. Circle one answer.

1) Given R = { (1,3), (2,1), (3,4), (4,2) }. Find R^{-3}
a) { (1,4), (2,3), (3,2), (4,1) } b) { (1,3), (2,1), (3,4), (4,2) }
c) { (1,2), (2,1), (3,4), (4,3) } d) { (1,3), (2,4), (3,2), (4,1) }

2) Given A = {1,2,3,4} and R = { (a,b) | a + b < 7 }. Which one is correct?
a) reflexive (T); symmetric (F); anti-symmetric (T); transitive (F)
b) reflexive (T); symmetric (F); anti-symmetric (T); transitive (T)
c) reflexive (F); symmetric (T); anti-symmetric (F); transitive (F)
d) reflexive (F); symmetric (T); anti-symmetric (F); transitive (T)

3) Given R = { (1,1),(1,2),(1,4),(2,1),(2,2),(2,4),(3,3),(4,1),(4,2),(4,4) }.
Find the equivalence classes.
a) {1,3}, {2}, {4} b) {1,2,4}, {3}
c) {1,3}, {2,4} d) {1,3,4}, {2}

4) Which relation is a total order?

a) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$

5) What is the transitive closure of R = { (1,2), (2,3), (3,1) }?

a) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$

6) Given A = {1,2,3} and B = {2,3,4}. How many relations from A to B?
a) 512 b) 256 c) 128 d) 64

Part 2 Each problem is worth 4 points. Write complete solution.

7) Give example of a relation R on A = {1,2,3,4}, one for (a) and one for (b).
(a) reflexive (T); symmetric (T); anti-symmetric (F); transitive (F)
(b) reflexive (F); symmetric (T); anti-symmetric (F); transitive (T)

8) Let A = { 1, 2, 5, 10, 20 } and R = { (a,b) | b mod a = 0 }
a) Find the elements of R.
b) Draw the digraph.
c) Prove that R is a partial order relation.
d) Draw the Hasse diagram.

-Amin Witno